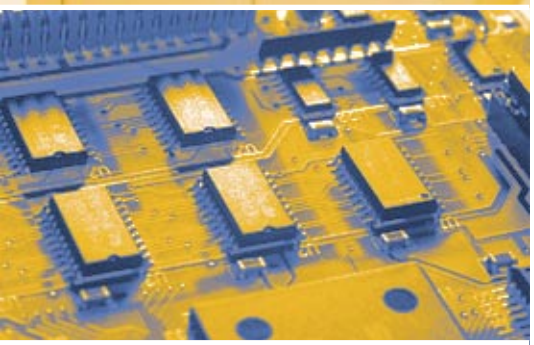
Immunity Tests



EMC - PARTNER

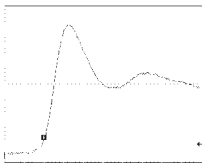
One Box EMC Test Stations

TRA-System

Brief Overview of Phenomena

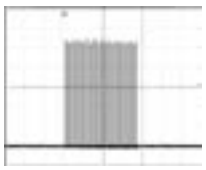
The One Box EMC Test Stations (TRA2000, TRA2000IN4, TRA2000IN6) replicate EMC events that can be observed in the low power distribution system, telecommunication or data lines. They are available in a number of basic versions which can be upgraded to give full test capability at a later date.

The One Box EMC Test Stations can replicate the following phenomena:



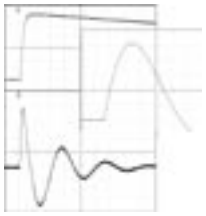
- **Electrostatic Discharges (ESD)**

  A person becomes electrostatically charged by walking over an insulating floor surface. The capacity of the body can be charged to several kilovolts and is discharged when contact is made with an electronic unit or system. The discharge is visible as a spark in many cases and can be felt by the person concerned, who receives a „shock". The discharges are harmless to humans, but not to sensitive, electronic equipment. The resulting currents cause interference or make entire systems „crash".



- **Electric Fast Transients (EFT) / Burst**

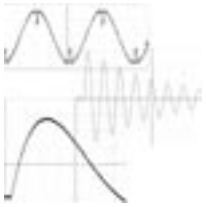
  Industrial measurement and control equipment nearly always use conventional control units containing relays or other electro-mechanical switching devices. Fluorescent lamp ballast units, insufficiently suppressed motors (hair dryers, vacuum cleaners, drills, etc.) are found everywhere in the public power supply. All of these are primarily inductive loads which generate interference when switched on or off. EFT events, can cause microprocessor units to malfunction or reset, with corresponding disruption to normal operation.



- **Combination Wave Generator (CWG), Ring Wave and 10/700µs**

  Surge events can be generated by lightning phenomena, switching transients or the activation of protection devices in the power distribution system. A surge itself is influenced by the propagation path taken so that impulses from the same event may have different forms depending upon where a measurement is taken. Combination Wave Generators (CWG) simulate a surge event in power lines close to or within buildings. Ring waves are bipolar oscillatory events, only measured on power lines within a well protected environment. Because of the special impedance characteristics within telephone systems, surges tend to be longer and are represented by the 10/700µs waveform.

  Mostly the disturbances are tolerable because they are single events.



- **Power Frequency and Pulse Magnetic Fields**

  Under normal operating conditions, an AC current generates a steady magnetic field so that equipment, such as monitors, close to AC power lines could suffer interference. Under fault conditions, a sudden high current level can result in a short duration magnetic field.

  Lightning strokes or short circuit fault currents in the power network can generate high level short duration magnetic fields.

- **AC & DC Dips/Interrupts**

  Voltage failures occur following switching operations, short-circuits, response of fuses and when running up heavy loads.

  The quality of the electrical power supply is increasingly becoming a central topic of discussion. The interference sources in the mains, caused by electronic power control with non-linear components e.g. thyristors are used more frequently in domestic appliances such as hotplates, heating units, washing machines, television sets, economy lamps, PCs and industrial systems with speed-controlled drives.

Options are available to expand the basic One Box EMC Test Stations to include:

- Common mode tests (DC to 150kHz)
- Telecommunication tests (10/700µs balanced & un-balanced)
- Three phase testing to 32A (EFT, surge, ring wave)
- Three phase testing to 32A (dips & interrupts)

Applicable Standards

International Electrotechnical Committee (IEC)

IEC 61000-4-2 (A2:2000): Testing and measurement techniques - Electrostatic discharge immunity test.

IEC 61000-4-4 (Ed2:2004): Testing and measurement techniques - Electrical fast transient / burst immunity test.

IEC 61000-4-5 (A1:2000): Testing and measurement techniques - Surge immunity test.

IEC 61000-4-8 (A2:2000): Testing and measurement techniques - Power frequency magnetic field immunity test.

IEC 61000-4-9 (A2:2000): Testing and measurement techniques - Pulse magnetic field immunity test.

IEC 61000-4-11 (Ed2:2004): Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests.

IEC 61000-4-12 (A2:2000): Testing and measurement techniques - Oscillatory waves immunity test (Ring wave).

IEC 61000-4-16 (A2:2000): Testing and measurement techniques - Test for immunity to conducted, common mode disturbances in the frequency range 0Hz to 150kHz.

IEC 61000-4-29 (A2:2000): Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests.

European Standard (EN)

The same standards are applicable as for IEC (see above).

International Telecommunications Union (ITU)

K.20 (February 2000): Resistibility of Telecommunications Equipment installed in a telecommunications centre to overvoltages and overcurrents

American National Standards Institute (ANSI)

C62.41 (Date): American National Standard for Electrostatic Discharge Test Methodologies and Criteria for Electronic Equipment.

Test System Overview

Test System Feature

The One Box EMC Test Stations have many unique and outstanding features:

- up to 6kV surge levels
- CWG, 10/700µs **and** ring wave together in one instrument
- Internal motor variac
- All parameters on one screen
- Parameter change during operation (+/-)
- Internal program memory
- Backlit LCD display
- Electronic polarity change
- Semiconductor switches
- Compact design
- Fulfills ALL standard requirements
- Magnetic field test menu
- Expansion to 3-phase capability
- Remote control and software upgrade through standard interface
- Wide range of accessories
- 2 year warranty

User Benefits

The technical excellence and many unique features of the One Box EMC Test Stations translate directly into benefits for the user:

- Cost effective solution to meet many test requirements
- Increase quality of test object
- Real time parameter change, ideal development tool
- Save operator time with the automated test routines and test report facility
- Easy integration into a full test suite
- Unparalleled reliability and system up-time

Generators

Available with single or multiple events (ESD, EFT, surge, ring, dips), EMC PARTNER's One Box EMC Test Stations can be upgraded to add further capability when required. Unique in their class, the One Box EMC Test Stations include as standard an internal motor variac to enable dips and variation tests, at any user programmable level, as per IEC 61000-4-11.

For all One Box EMC Test Stations, the most significant test parameters can be programmed and then adjusted in real time to assist in finding the exact immunity level of an EUT. The +/- keys are used to adjust; test voltage level, EFT spike frequency, EFT burst duration, synchronisation angle, polarity and EUT supply voltage (via internal variac). The coupling paths; Line, Neutral and Protective Earth can either be automatically programmed or manually selected using switches on the front panel.

As standard accessories the One Box EMC Test Stations are equipped with 10A and 16A mains cables, GENECS remote control software on a CD, serial link cable to use with the GENECS software, user manual with verification protocol and conformity declaration.

- **TRA2000**

  Capable of being equipped with ESD up to 15kV air discharge (requires ESD2000), EFT, CWG up to 4kV (1.2/50µs open circuit and 8/20µs short circuit), AC dips/ interrupts & variations plus DC interrupts. TRA2000 features a single phase 16A AC/DC CDN enabling all power borne immunity tests to be performed on a single EUT without unplugging or reconfiguring the test set-up.

  TRA2000 limited feature versions can be upgraded to full configuration when the need for additional tests arises.

- **TRA2000IN4**

  Similar to TRA2000 as described above, TRA2000IN4 has enhanced capability in the form of a 10/700µs surge impulse for telecom testing up to 4kV and the 100kHz ring wave for ANSI C62.41 and IEC61000-4-12, up to 6kV. Just like TRA2000, an automatic integrated single phase CDN enables EUT power to be supplied continuosly even when switching between test types.

- **TRA2000IN6**

  A further enhancement of the TRA2000, TRA2000IN6 is the most complete compact generator available offering in a single unit phenomenal power and unparalleled capability. All the features available in both TRA2000 and TRA2000IN4 are include in the TRA2000IN6, plus the ability to perform CWG 1.2/50µs open circuit and 8/20µs short circuit and 10/700µs surges up to 6kV.

Long duration testing is made easier by use of the EMC PARTNER software packages. Using either GENECS or TEMA software, the units can be programmed, automatically started and test reports generated.

The compact design enables many different test standards to be performed using only a single unit. A broad range of accessories enable testing to many additional applications.

Unique in their class, TRANSIENT systems include as standard an internal motor variac to enable Dips and Variation tests, at any user programmable level, as per IEC 61000-4-11. Special configurations are available to meet unique customer requirements, long duration voltage interrupts as required for Electricity meter testing (IEC62052-11 Annex B) are one example of the many unique capabilities available with EMC Partner TRANSIENT generators.

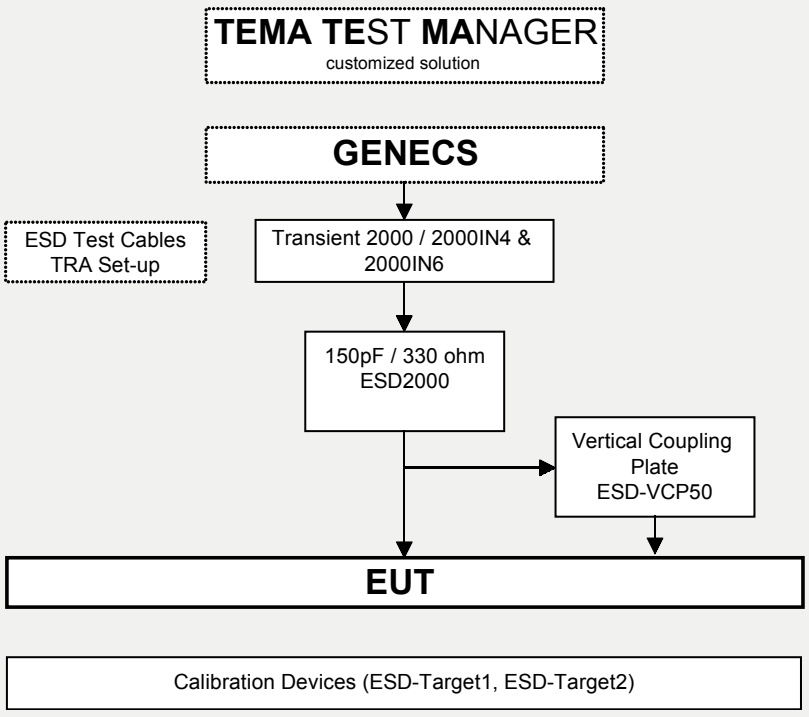
TRA2000

TRA2000IN4

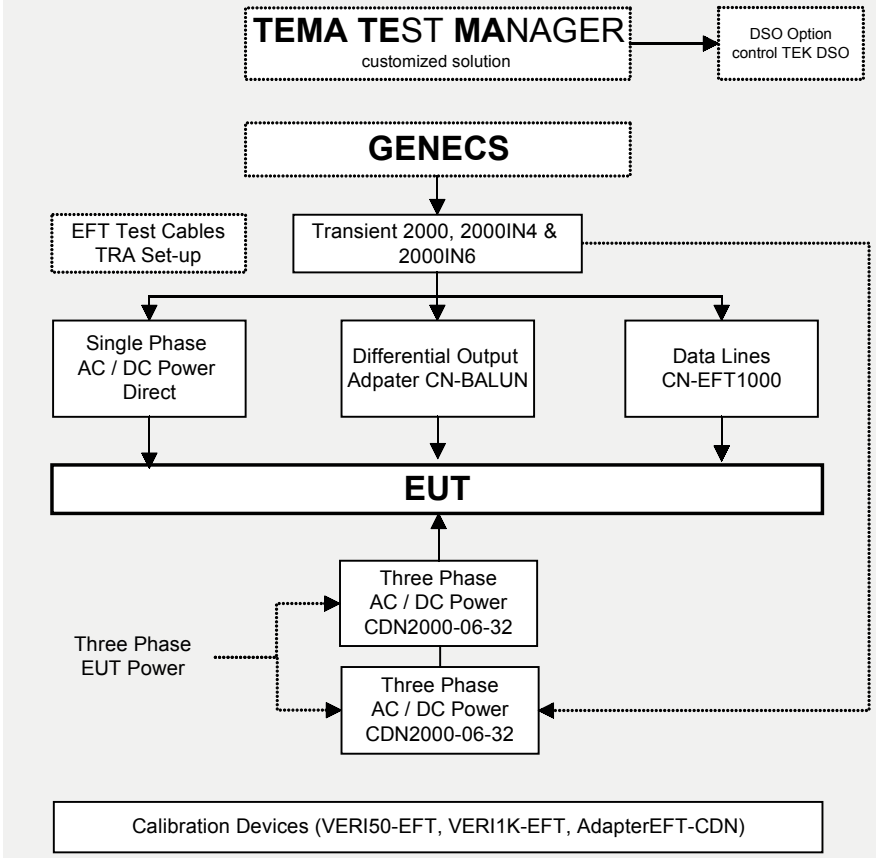
TRA2000IN6

Flowcharts

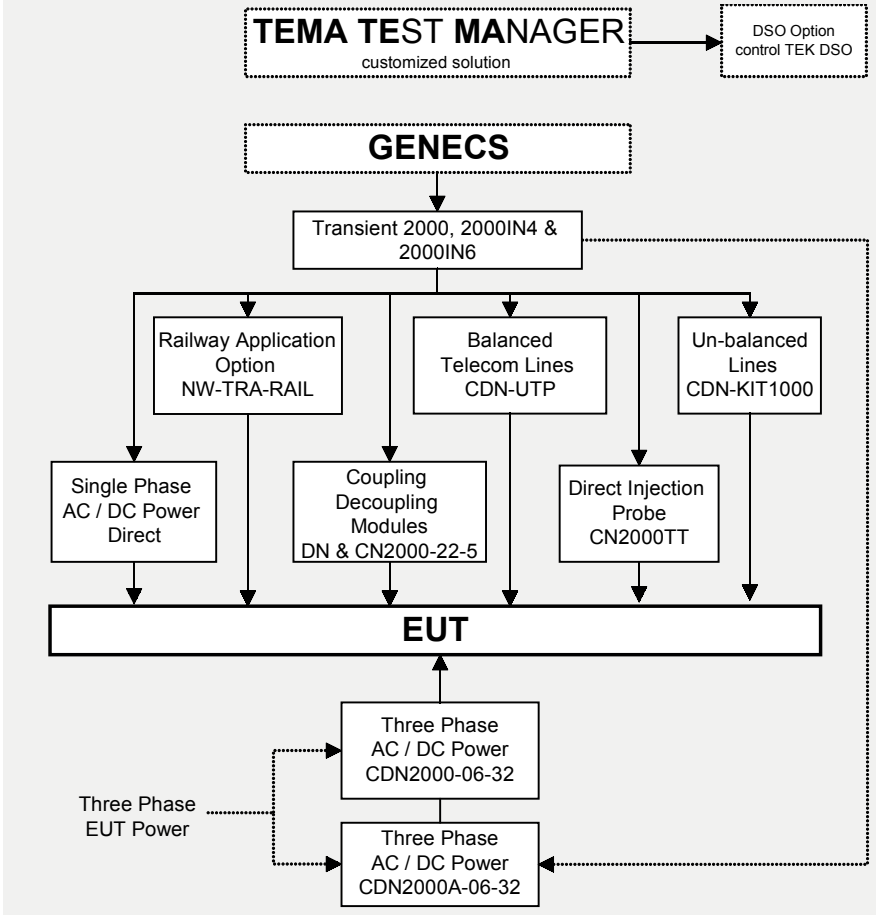
ESD



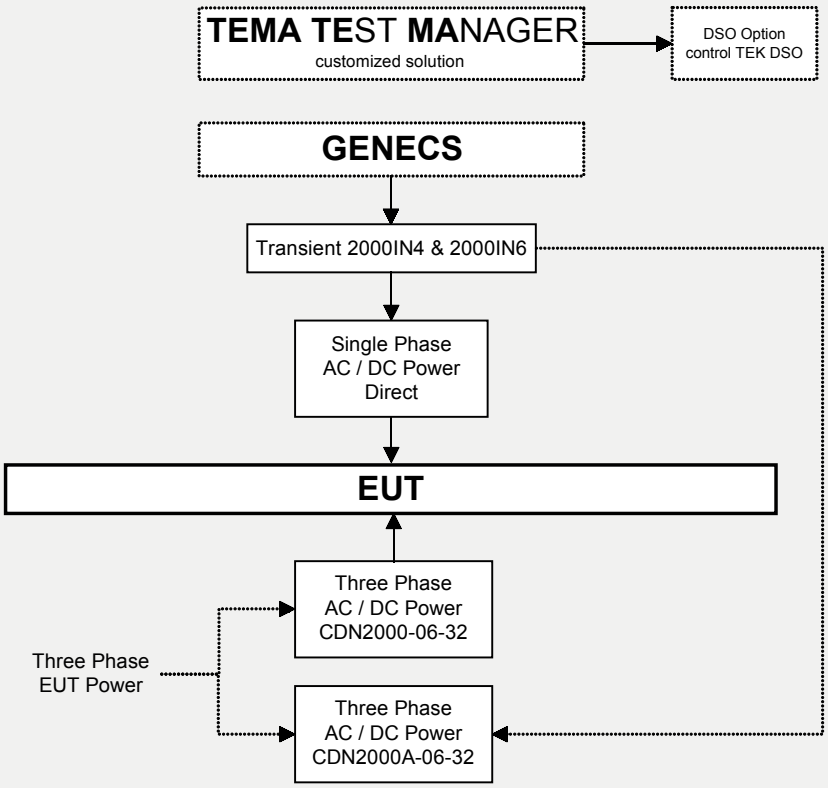
EFT


TEMA TEST MANAGER
customized solution
DSO Option
control TEK DSO
GENECS
EFT Test Cables
TRA Set-up
Transient 2000, 2000IN4 &
2000IN6
Single Phase
AC / DC Power
Direct
Differential Output
Adpater CN-BALUN
Data Lines
CN-EFT1000
EUT
Three Phase
AC / DC Power
CDN2000-06-32
Three Phase
EUT Power
Three Phase
AC / DC Power
CDN2000-06-32
Calibration Devices (VERI50-EFT, VERI1K-EFT, AdapterEFT-CDN)

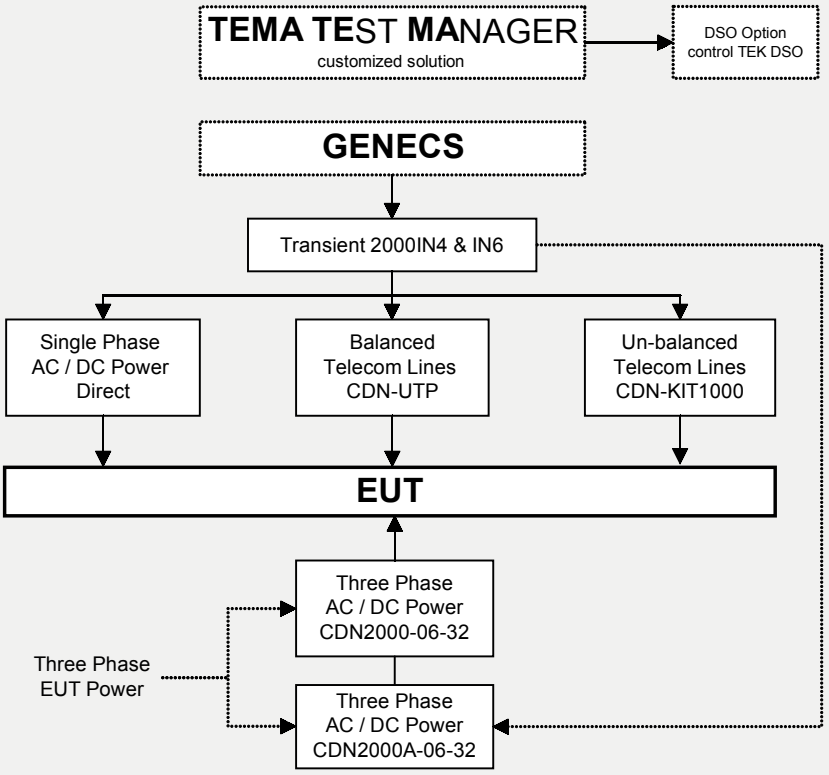
CWG


TEMA TEST MANAGER
customized solution
DSO Option
control TEK DSO
GENECS
Transient 2000, 2000IN4 &
2000IN6
Railway Application
Option
NW-TRA-RAIL
Balanced
Telecom Lines
CDN-UTP
Un-balanced
Lines
CDN-KIT1000
Single Phase
AC / DC Power
Direct
Coupling
Decoupling
Modules
DN & CN2000-22-5
Direct Injection
Probe
CN2000TT
EUT
Three Phase
AC / DC Power
CDN2000-06-32
Three Phase
EUT Power
Three Phase
AC / DC Power
CDN2000A-06-32

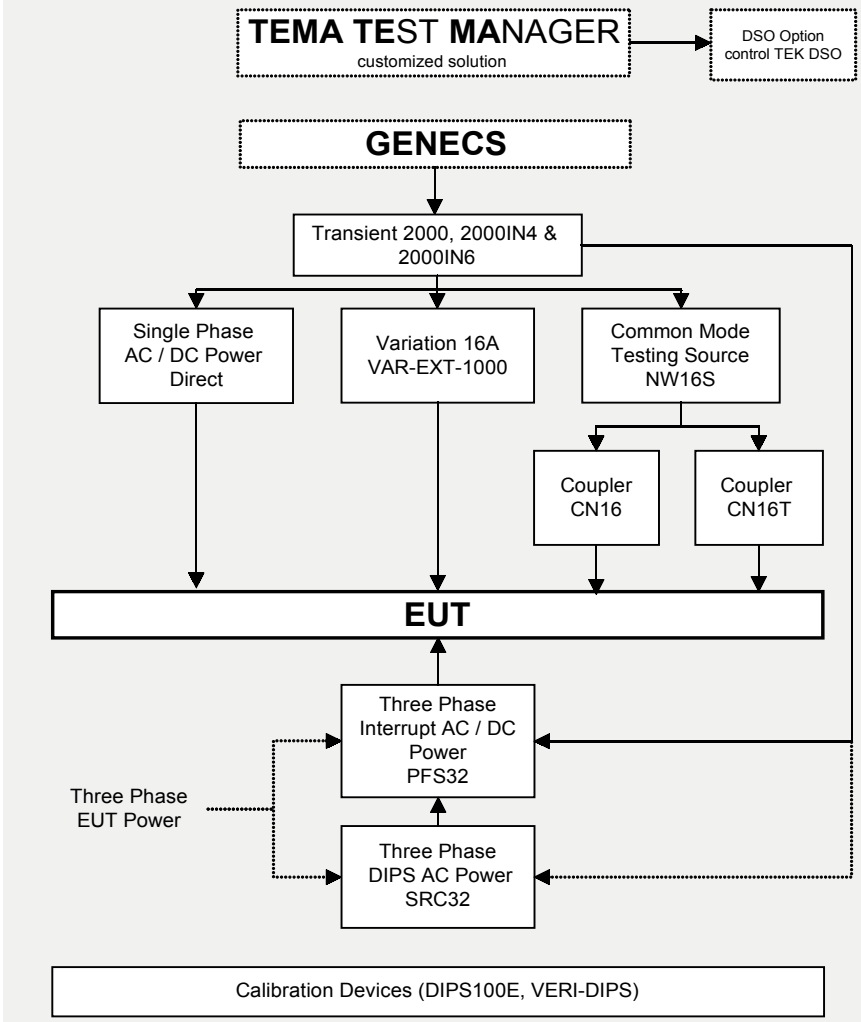
Ring Wave 100kHz



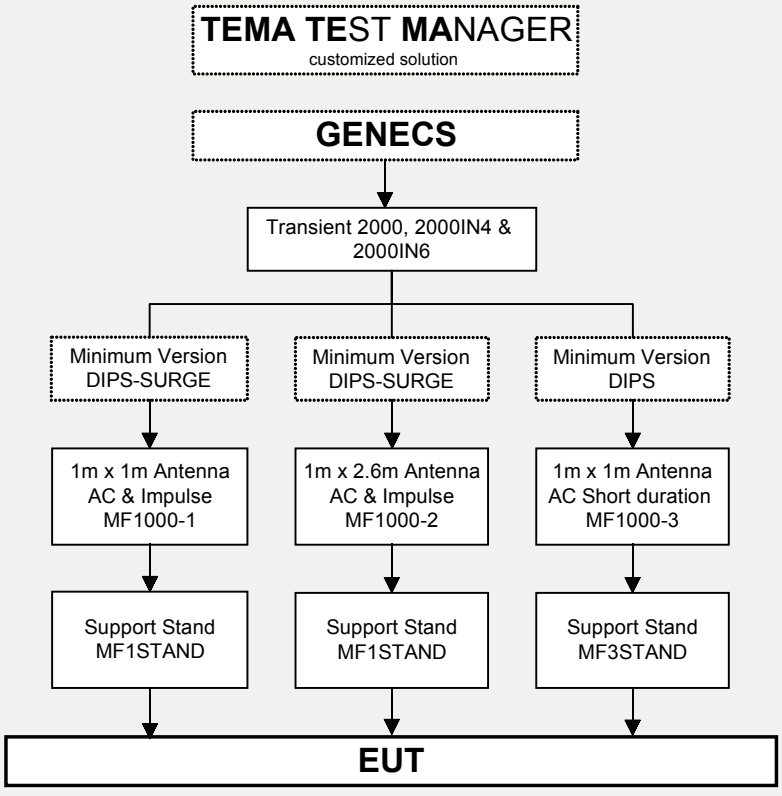
10/700µs



Dips/Variations and Common Mode Tests



Magnetic Fields



Specifications

ESD

Air discharge	2 up to 16kV
Contact discharge	2 up to 10kV
Voltage increment resolution	1 volt steps
Contact discharge repetition interval	0.05 to 30s
Discharge detection	every pulse or real discharges only
Discharge counter	1 to 29999
Discharge polarity	positive, negative and alternating
Holding time	5s
Programmable parameter ramps	voltage, polarity
Discharge trigger	manual or automatic

EFT

Voltage range	0.25 up to 4.4kV
Source impedance	50ohm
Pulse front time at 50ohm	5ns
Pulse duration at 50ohm	50ns
Spike repetition frequency	up to 1MHz
Programmable parameter ramps	voltage, spike frequency, burst duration, synchronisation
Spike distribution	IEC burst pattern and random

CWG

Voltage range	0.25 up to 4.1kV for TRA2000IN4 / 6kV for TRA2000IN6
Current range	0.125 up to 2.1kA / 3kA for TRA2000IN6
Source impedance	2ohm
Pulse front time at open circuit	1.2µs
Pulse duration at open circuit	50µs
Pulse front time at short circuit	8µs
Pulse duration at short circuit	20µs
Pulse repetition	up to 20 pulses per minute
Programmable parameter ramps	voltage, synchronisation
Synchronisation on power line frequencies	16Hz up to 400Hz

10/700µs

Voltage range	0.25 up to 4kV / 6kV for TRA2000IN6
Current range	16.6 up to 266A for TRA2000IN4 / 400A for TRA2000IN6
Source impedance	15ohm + 25ohm
Pulse front time at open circuit	10µs
Pulse duration at open circuit	700µs
Pulse front time at short circuit	4µs (40ohm)
Pulse duration at short circuit	300µs (40ohm)
Pulse repetition	up to 4 pulses per minute

100kHz Ring Wave

Voltage range	0.25 up to 6kV
Current range	20 up to 500A
Source impedance	12ohm & 30ohm
Pulse front time at open circuit	0.5µs

Pulse oscillation frequency	100kHz
Pulse decay	60% first to second peak
Pulse repetition	up to 10 pulses per minute

Dips/Interrupts

Voltage range	0 up to 260Vrms
Frequency range	DC up to 400Hz with external supply
Rated current	16A for dips 0/100%
Interruption period	50µs up to 30s
Selectable dip range	0 up to 100% continuously
Phase synchronisation	dips, interrupts & EUT supply

One Box EMC Test Stations Selection Guide

Generator	Circuit(s)	Upgrade
TRA2000	ESD, EFT, surge, dips	No
TRA2000	dips	Yes
TRA2000	ESD, EFT	Yes
TRA2000	surge, dips	Yes
TRA2000	ESD, EFT, dips	Yes
TRA2000	ESD, EFT, surge	Yes
TRA2000	EFT, surge, dips	Yes
TRA2000	surge	Yes
TRA2000	EFT	No
TRA2000IN4	ESD, EFT, surge, 10/700, ring wave, dips	No
TRA2000IN4	EFT, surge, 10/700, ring wave, dips	No
TRA2000IN6	ESD, EFT, surge, ring wave, dips	10/700µs
TRA2000IN6	EFT, surge, ring wave, dips	No
TRA2000IN6	surge, ring wave, dips	No
TRA2000IN6	EFT, surge	No
TRA2000IN6	ESD, surge	No

System Expansion Options

TRA2000 with PFS32 and SRC32

PFS32 and SRC32 for Three Phase Dips and Interrupts

PFS32 and SRC 32 are an option to One Box EMC Test Stations to simulate effects of power line interruptions caused by short circuit or open circuit conditions. This is an expansion of the One Box EMC Test Stations' single phase capability to enable testing on three phase power lines. The relevant recommendations are IEC 61000-4-11 for AC power lines and IEC 61000-4-29 for DC power lines.

PFS32 extends the system to provide three phase testing of AC and DC interrupts up to 480V and 32A.

SRC32 is a 480V AC source controllable from the TRA2000 to generate dips at the IEC61000-4-11 fixed levels (0%, 40%, 70%, 80%).

Coupling path switching and the selection of dip levels is automatically performed from the TRA2000 control system. dips/interrupts can be synchronised to any phase.

CDN2000-06-32 for Three Phase Coupling

CDN2000-06-32

One Box EMC Test Stations can be extended with automatic or manual three phase coupling networks. The CDN2000A-06-32 and CDN2000-06-32, can be used for EFT, CWG surge and ring wave. Coupling path selection is either from the One Box EMC Test Stations firmware, from GENECS and TEMA software or manually on the CDN front panel (manual version only). The coupling networks fulfill the requirements laid down in the IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-12 (ring wave) and ANSI C62.41 standards.

One Box EMC Test Stations		Three Phase CDN	
Generator	**Internal CDN**	**Generator**	**External CDN**
TRA2000	280V L/N- PE L to N 280V	CDN2000A-06-32 or CDN2000-06-25 or CDN2000-06-32	280V Lx/N to PE 415V Lx - LX/N
TRA2000	280V L/N- PE L to N 280V	CDN2000A-06-32 Option 480V	280V Lx/N to PE 480V Lx - LX/N
TRA2000IN4	280V L/N- PE L to N 280V	CDN2000A-06-32 or CDN2000-06-25 or CDN2000-06-32	280V Lx/N to PE 415V Lx - LX/N
TRA2000IN4	280V L/N- PE L to N 280V	CDN2000A-06-32 Option 480V	280V Lx/N to PE 480V Lx - LX/N
TRA2000IN6	280V L/N- PE L to N 280V	CDN2000A-06-32 or CDN2000-06-25 or CDN2000-06-32	280V Lx/N to PE 415V Lx - LX/N
TRA2000IN6	280 V L/N- PE L to N 280 V	CDN2000A-06-32 Option 480V	280V Lx/N to PE 480V Lx - LX/N
TRA2000IN6	280V L/N- PE L to N 280V	CDN2000A-06-32[1] or CDN2000-06-25 or CDN2000-06-32	280 V Lx/N to PE 415V Lx - LX/N

[1] OPTION 480V / CMC extends the TRA2000IN6 for L1+L2+L3+N to PE (ANSI C62.45).

CDN-UTP

CDN-UTP

The CDN-UTP is a sophisticated coupling and de-coupling network for superimposing surge impulses on balanced communication lines in accordance with IEC61000-4-5 (Figure 12: unshielded symmetrical interconnection lines), ITU-K20, K21 and FCC part 68.

It is designed for 1.2/50µs and 10/700µs pulses up to 6.6kV.

CDN-UTP is also available with 4 pairs (8 lines) as the CDN-UTP8 version.

Common Mode Tests

NW16S

CN16

Applicable standard is IEC61000-4-16. This defines three test types:

1. DC voltages
2. AC voltages (50/60Hz)
3. Sweep voltages from 0 up to 150kHz.

AC and DC voltage tests can be performed from the One Box EMC Test Stations controller by adding the NW16S voltage source. Tests can then be performed for

- continuous mode (with 2 ranges up to 1V and up to 30V)
- short duration mode (1s up to 10V and up to 300V)

Two coupling networks are available: CN16 for power lines and CN16T for telecom lines.

N.B. Sweep voltage tests cannot be performed.

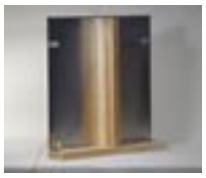
Accessories

ESD2000

ESD2000

ESD discharge network for use with One Box EMC Test Stations to fulfill IEC61000-4-2 requirements. For full details, please refer to brochure “ESD Testers”.

Vertical Coupling Plate ESD-VCP50



TEST SETUP

Test package for ESD and EFT testing. This includes all the mechanical items needed to perform these test types. Vertical coupling plate with 2 x 470kohm resistors and 2 x 10cm EFT insulation.

CN-EFT1000

CN-EFT1000

Capacitive coupling clamp 100ohm according to IEC 61000-4-4 including 1m coax cable with BNC connectors.

VERI50EFT

VERI50EFT

50ohm termination with high voltage BNC connector and integrated divider for EFT calibration / verification in accordance with IEC61000-4-4 Ed2.

VERI1KEFT

VERI1KEFT

1kOhm termination with high voltage BNC connector and integrated divider for EFT calibration / verification in accordance with IEC61000-4-4 Ed2.

ADAPTER EFT-CDN

Adapter cable which enables EFT impulses to be measured at the output of either a single or three phase CDN as required by IEC61000-4-4 Ed.2.

CN16-450C

CN16-450C

Single phase CDN for superimposing surge and EFT into power lines. EUT power supply up to 16A at 115V 400Hz.

CN-BALUN

CN-BALUN

Balanced/unbalanced transmission line transformer for EFT and 1MHz damped sine according to ANSI/IEEE C.37.90. Including coaxial cable with HV-BNC plugs (3x 0.5m), test tip + HV-BNC adapter (1 red, 1 black) and HV-BNC connector (2x).

CN2000TT-MC with TRA2000

CN2000TT-MC

Two test pistols for direct current injection of surge and 10/700µs according to IEC 61000-4-5. Cable length 1.5m with MC plugs. The test pistols can be used together with MIG system equipped with MC plug outputs on front panel or networks (NW).

CDN-KIT1000

CDN-KIT1000

Surge coupling-decoupling network for data lines according to IEC 61000-4-5. Comprises one universal coupling module, one low frequency and one high frequency decoupling module.

VAR-EXT1000

External 16A variac module to extend the TRA2000 internal capability for higher powered EUTs.

VAR-EXT1000

DIPS100E

100ohm non-inductive resitor for calibration of dips/interrupts switching times. To be used with One Box EMC Test Stations, PFS32 and PFS63.

DIPS100E

VERI-DIPS

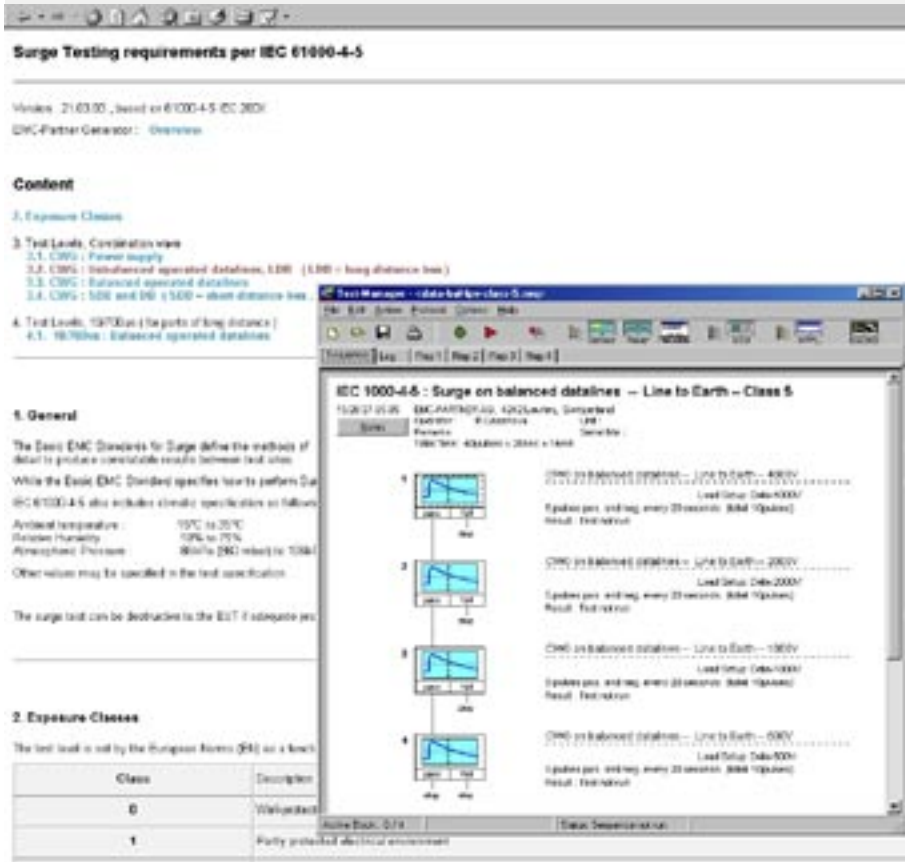
Measuring set for calibration/verification of the EUT inrush current. Used with One Box EMC Test Stations, PFS32 and PFS63.

VERI-DIPS

Software

For remote control of One Box EMC Test Stations systems, the OPTICAL LINK and one of the following software packages is needed:

- GENECS: is a relatively simple program that reproduces generator front panel functions on a PC. In addition to remote programming and control of the generators, test report information is available to word processing or other evaluation programs such as EXCEL. GENCES is supplied with each instrument or downloaded free of charge from the EMC PARTNER website. Firmware can be updated using the serial link provided.
- TEMA Software: Comfortable control of EMC PARTNER generators from a PC. Includes also control for ESD3000 and MIG2000 systems. Generates an enhanced level of test report.

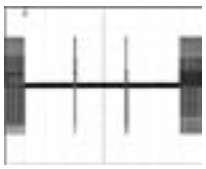


Predefined test routines

Further Applications

The One Box EMC Test Stations are so flexible they can be used in many applications other than for EMC.

Example of interrupt capability



Electricity Meter Testing

TRA OPTION TEST 3.2 extends the standard burst and dips/interrupts capability to fulfill IEC62052-11 and Indian standard 13779.

Three bursts of 1s duration within a 10 minute period.

Three Interruptions lasting one second each with 50ms spacing, in accordance with IEC62052-11 annex B.

OPTION NW-TRA-RAIL

Railway Testing

OPTION NW-TRA-RAIL fulfills the waveform A impulse requirement from IEC 60571 Ed. 2.0b, EN 50155 and RIA12.

Waveform A: 5/50µs (1.8kV), Z_{out} 100 ohm.

In combination with the ESD3000DM8 which generates the higher level waveform B impulse

Please refer to brochure ESD Testers for further details.

MF1000-1
MF1000-2
MF1000-3

Magnetic Field Testing

Applicable standards are IEC 61000-4-8 for a.c. and IEC 61000-4-9 for impulse magnetic fields.

One Box EMC Test Stations can be extended by the MF1000 coil antennas.

MF1000 antennas are used to generate magnetic fields when connected to the One Box EMC Test Stations' outputs. The following levels can be reached:

Antenna	Coil dimensions	AC magnetic fields (50/60Hz)	Impulse magnetic fields (8/20µs)
MF1000-1	1m x 1m	1 up to 130A/m	0.1 up to 1.5kA/m
MF1000-2	1m x 2.6m	1 up to 110A/m	0.1 up to 1.1kA/m
MF1000-3	1m x 1m	0.3 up to 1kA/m	

EMC PARTNER's Product Range

The Largest Range of Impulse Test Equipment up to 100kA and 100kV.

Immunity Tests

The TRA2000 performs all of the following transient tests on electronic equipment as required for the CE-mark up to full levels: ESD, EFT, surge, dips, a.c. magnetic field, surge magnetic field and common mode tests. A large range of accessories for different applications is available: MF antennas, three phase couplers, verification sets, coupling kits, etc. The TRA2000 complies with IEC 61000-4-2, -4, -5, -8, -9, -11, -12p, -16, -29p.

TRA2000, ESD3000 and CDN2000A-06-32 – a complete automatic three-phase test system

Lightning Tests

EMC PARTNER offers a wide range of testers in accordance with national and international standards. These include FCC 68 part D, ITU K.44, ETS 300 046, Bellcore GR1089 for telecom, RTCA DO160D for aircraft and MIL-STD-461E for military electronic equipment testing.

MIG0600MS and MIG-OS-MB – a multiple stroke and multiple burst aircraft test system

Component Tests

EMC PARTNER offers a wide range of modular impulse generators (MIG) for transient component testing on: varistors, arresters, surge protective devices (SPD), capacitors, circuit breakers, watt-hour meters, protection relays, insulation material, suppressor diodes, connectors, chokes, fuses, resistors, emc-gaskets, cables, etc.

MIG1212CAP – an automatic 8 bank capacitor test system

Emission Measurements

One unit performs all measurements on the power supplies of electronic equipment and products for the CE-Mark.

The HAR1000 includes an amplifier for a clean power source, a line impedance network, the measurement systems Harmonics and Flicker. Accessories: three phase extension and HARCS Immunity software. Complies with IEC/EN 61000-3-2 and -3.

HAR1000-3P and HARCS Software – a complete three-phase harmonics and flicker test system

For further information please do not hesitate to contact EMC PARTNER's representative in your region. You will find a complete list of our representatives and a lot of other useful information on our website:

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Version 27 May 2005. Subject to change without notice.